DOCUMENT RESUME

ED 341 287 FL 020 057

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TITLE The Relevance of Repair for Self Explicating Artifacts.
PUB DATE 91
NOTE 9p.; In: Communication and Discourse across Cultures and Languages. AFinLa Yearbook 1991; see FL 020 041.
PUB TYPE Speeches/Conference Papers (150) -- Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Applied Linguistics; *Artificial Intelligence; *Computational Linguistics; Discourse Analysis; *Error Correction; Finnish; Foreign Countries; *Interdisciplinary Approach; *Language Processing; Sign Language; Uncommonly Taught Languages
IDENTIFIERS *Repairs (Language)

ABSTRACT

An in-progress interdisciplinary research effort, Conversation Analytic (CA) and Human-Computer Interaction (HCI) study, is reported. A conversation analytic approach to repair and self-explication is taken that covers both human studies and artificial intelligence. The term "human" is used here in place of "linguistic." Three definitions of "repair" are given to show how artificial intelligence, discourse analysis, and conversational analysis compare. Some results are reported of empirical investigations of Finnish sign language, computer interfaces in general, and a special case of a telephone computer dialogue system. The study to date indicates that the whole concept of repair work needs to be analyzed carefully in order to sort out the subcategories. Contains 9 references. (LB)

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THE RELEVANCE OF REPAIR FOR SELF EXPLICATING ARTIFACTS

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Introduction

This paper reports on an interdisciplinary research effort, Conversation Analytic (CA) and Human-Computer Interaction (HCI) studies, which is in progress. I would like to start by explaining what is meant by some concepts in the title, as they might seem to be a bit far from the theme, ie. discourse and language. Dictionary definitions offer a good starting point, so let us begin from the end of the title (self explicating artifacts) and see what is meant by an artifact:

1a a usu simple object (eg. a tool or ornament) produced by human workmanship *b* a product of civilization *<an ~ of the jet age>* 2 sthg (eg. a structure seen in the microscope) unnaturally present through extraneous influences (eg. from defects in the staining procedure) (New Penguin English Dictionary)

Artifacts that are easy to use could be intuitively divided into two classes (cf. definitions *a* and *b* above): (i) artifacts that are very handy (literally) - the purpose they are used for has affected, for example, the shape and material of the tool; and (ii) artifacts that are self explicating in the sense that how they should be used is not problematic. These two definitions are by no means in a mutually exclusive distribution; rather, a self explicating artifact usually has both features. The first category is roughly to do with everyday actions like killing for food (the early man) and cooking (the present man) - the tools should be as practical as possible. In the second category the tools or objects are more like human beings whom we can understand (most of the time) if we speak the same language. Computer interfaces, though far from being human, come under the second heading, too. For both categories, it is common that we know what we want to do with them - the problem, if there is any, is how? The higher the usability of the artifact, the more explicable it is in interaction with people: you can manage the interaction without having to adhere to external help. In the second class a regular property is that language is involved, but in the absence

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of the author/designer language is not all that matters. For humans, the context of the situation - gestures, facial expressions, body posture - is as important as the verbal contribution, and for computers the textual language is very limited - most of the time a jargon has to be learnt before you can use a machine. There are of course other objects than computers that 'use' language (which actually might have computers embedded within). A washing machine 'tells you' what you can do with it, if not verbally, then through signs whose meaning is straightforward (self explicating) or (internationally/conventionally) agreed upon. Thus, the division into two types of artifacts could be a partition into tools usable as such and tools that are operated through a machinery, as the latter case might involve written language and other symbolic signs.

Next, we need to explain what is meant by 'repair' as it is the very nature of the concept that my research is focusing on. However, the notion of repair is not that simple. The working definition presented here is in the form of a list. There is a clear impact from Conversation Analytic studies:

(i) Repair work is to be found in human everyday actions, and it is assumed to be the basic way of action: the world is not a place where the inhabitants do their actions in predesigned ways without having to adhere to corrective or revisive management of them.

(ii) People act first and foremost situatedly - no cognitive modelling can override the *in situ* nature of human action, including repair; the situated character of actions means we cannot dismiss language, body, objects around, time - everything is relevant but does not have to be represented at all times.

(iii) Language is action, but there is a special relation between linguistic and other activities, including repair work; repair work in this study also concerns actions to do with non-linguistic items in the world, with the special case of the "language-using" computer.

(iv) We make sense; of our own activities to ourselves (to a certain extent), and others' activities to us - the sense making is methodical and illustrated in our activities and language use; problems here result normally in turn-analysis repair.

(v) Conversational speech is accomplished through the turn-taking mechanism - difficulties there lead into turn-taking repair.

(vi) Of the types of repair possible to initiate, self and other initiated self-repair is most preferred, other-initiated repair least preferred (in conversation).

Thus, repair work is given the status of an elementary method of understanding in our everyday life, where the situated nature of interaction with people and non-human entities is underlined. The relationship between linguistic and other actions should be examined, especially in case of repair work, and one specific case is human-computer interaction, where both are involved. The previous analyses into repair work have given the result of self-initiation being most preferred, and other-initiated least. The two types of repair refer to the possible difficulties in the actual method of analysing the other's turn: turn-analysis repair would cover eg. mishearings, where something in the turn is misunderstood; turn-taking repair would enclose misunderstandings where the whole of the turn, not a part of it, is mistaken for something else, eg. a question as a command. Further analysis will show whether this type of classification is needed at all.

Methodological background

A conversation analytic approach to repair and self explication is taken, which is a research topic that covers both human studies and artificial intelligence (AI). The term 'human' rather than 'linguistic' is used here, as the human being cannot be separated from her linguistic actions. There is no need to abstract the language and repair work away from the situation as has been done in the traditional linguistic research.

So, this research is relevant not only for CA, but also for AI and HCI (Human-Computer Interaction) studies. A thesaurus definition could be used to clarify the different views that AI, DA, and CA have on repair:

1 to restore by replacing a part or putting together what is torn or broken *2* to restore to a sound or healthy state *3* to remedy (New Penguin English Dictionary)

These three definitions of the word 'repair' look - superficially - similar to how Artificial Intelligence or Human-Computer Interaction studies, Discourse Analysis and Conversation Analysis see repair. The explanations look almost the same, but there are some crucial differences.

1 In AI and HCI, repair is mostly seen as something needed when a dialogue between a computer and its user is 'broken': the 'normal' flow of conversation has to be restored. Repair is needed when something goes seriously wrong. There seems to be a two-folded way of seeing communication as either exchanging message packages which should be easy to interpret with a sophisticated parser, or else that language discloses large scale scripts of behaviour or plans that we try to realise when in discourse. Neither of these allows for the local management of conversation where meaning would be interpreted on the spot, and does not depend on the conventional meaning of words or utterances, but on the context. For instance, a parser can only take a very limited number of contextual factors into account, and global models of dialogues cannot handle local phenomena. These are the main streams of AI research where new ideas have emerged (eg. Suchman, 1987) with an emphasis on the contextual phenomena.

2 Of linguistic studies, Discourse Analysis can be encountered as dealing substantially with conversations. In the formalistic branch of DA (eg. discourse grammar studies), repair is understood to do with corrections, misunderstandings, etc. that are regarded as faults in the discourse. The sociolinguistically oriented wing of DA research examines how speakers manage to keep the talk interactively smooth and polite, ie. where repair at least implicitly is needed to adjust the general atmosphere of the situation. This work is significant for second language studies, where students have to be made aware of when they might cause more serious problems than just making grammatical mistakes.

3 Conversation Analysis does not want to make any judgements or models of conversation *a priori*: where CA sees repair is when people have to do special work to maintain intelligibility. Certain patterns for this work have been found in CA studies, but nothing is said about when they will occur, ie. it is impossible to predict when certain type of repair sequence would develop. However, the question is about remedying the situation, though no accounts as to why the situation ensued are not given to avoid mentalistic explanations. The most significant outcome of CA studies is that repair work is regarded as a fundamental and pervasive feature of conversation: repair is not an emergency measure but an integral part of interaction - in speech and sign, as well as in non-verbal communication.

The non-vocal interactional activities where objects are included have been shown to have similar tendencies as the use of repair in talk. C. Goodwin (1981:145-146) considers an example in which one person gives a light to another person's cigarette. When the other person is distracted from the action, and does not have her cigarette ready to meet the light, the person offering the light adds a sequence to her actions, viz. she seems to find something wrong with the lighter and fiddles with it until her friend is ready to complete the action of lighting the cigarette and brings her cigarette forward. The example shows neatly the counterpart of conversational repair in an activity. Actually in face-to-face conversations we do not just analyse the previous speaker's turn in ours but adapt what we are saying according to the activities of the other person. C. Goodwin (1981) has studied video data of conversations, and shows how much the other interlocutor(s) affect what we are actually saying. Thus we continually monitor our co-speaker(s), which means that if self-repair is looked at, we have to have video data from the situation, as sometimes repetitions and reformulations are done just to gain the other's gaze rather than observing that she does not understand, ie. similar forms are used both for getting attention and to repair an error. However, by repairing the speaker at the same time secures that she makes herself understood: if there is no eye contact between the speaker and the hearer, the speaker cannot possibly be sure that the person she is talking to is actually listening.

Looking at data: preliminary results

In the following, some results of empirical investigations related to the topic, viz. Finnish sign language, computer interfaces in general and a special case of a computer dialogue system, will be discussed. The latter two studies were conducted in order to better appreciate the situated use of complex self explicating artifacts.

Finnish sign language (FSL)

The conversational repair will be examined through sign language, the linguistic system of which is fairly different from that of speech languages. Rissanen (1987:24) mentions the repetitive use of signs and the redundance thus created

in conversational sign, but leaves a closer look for further research. Abundant repetition means that in sign you seem to do more work to prevent misunderstandings. Repetitions do not seem to be self repairs, as is the case many times in speech, but they are a regular way of constructing a turn. As there has not been any clear cases of repair, the general structure (ie. how are repairs usually formulated) of sign repair has not been comparable to that of speech. There is a great deal of research done into repair in speech exchanges, and certain patterns have been found, eg. 'No, I mean' (when something in your cospeaker's turn shows that she has misinterpreted what you have said earlier). Further research is needed to show how the resources of the situation are used in the special case of a visual language: the constraints, conventions, reasoning and chance are different for sign, at least with respect to the constraints and conventions. Signers use plenty of pointing for instance, thus maybe using the immediate context to a greater degree than is done is speech. How that relates to repair work is yet to be determined. Turn-taking repair was mentioned before. Sign language is based on turn-taking also, but the special modality seems to tolerate eg. more overlapping (see eg. McIlvenny in this volume).

Computer interfaces

Computer interfaces serve as an example of attempts at self explication through textual prompting. In the following, the terms 'program' and 'machine' will be used almost synonymously with 'computer'. The data has been collected involving two persons at a computer using *Learning Word 5* teach yourself program. Some preliminary comments will be mentioned here. First of all, the program seems to employ some repair strategies. They appear to be implemented in accord with the designer's intuitions about communication situations: if the user does not react within a certain time, a further instruction will be presented. The effect on the users is very interesting, eg. when there are two users at a computer wanting to learn something about Word 5, also giving material on how they repair each other's misunderstandings when using the program. There are even some cases of speaking out the difficulties in interpreting (eg. A: Does this make sense?, B: Mm, not to me; or being perplexed as what to do next: Now, what will we do?). One thing to look at would be how the user deals with the machine that is giving him instructions, eg. what the general outlay of the screen means for people trying to make sense

of its 'turn'. Further, what does it mean to have such different constraints and conventions from human-human interaction in dealing with a machine, where the resources consist mainly of language seen on the screen, a mouse to move around to certain places to be clicked? With two people you get verbal commentary on possible problems which helps the analyst to understand how the machine's behaviour is interpreted.

Telephone answering system

The telephone answering system provides an environment for self explication through dialogue metaphor. In the case of a hypothetical computer telephone answering system which was intended for showing the contingencies of on-line speech dialogues, the attempt was to give local possibilities for the user to manage repair when dealing with a computer system. For this, some repair strategies were implemented: it was possible for the computer to randomly pick one of the following ways of repairing

(1) Specify the source of trouble: "Leave what?"
(2) Imply not hearing our understanding the user: "Sorry?"
(3) Have a guess what the user tries to do: "Do you mean —?"
(4) Specify for the user as what is possible to do with the system: "You can leave messages or listen to messages - select either"
(5) Precheck everything is alright before proceeding in the program: "So you want to ---, is that right?"

It was important that the simulation happened on-line, so the users would have to react in real-time. A result of this investigation was that it is very hard to predict how people will interpret a predesigned piece of language. Though in this case the system was trying to get relevant information from the user by adhering to repair initiators like "Sorry?", "Do you mean to send a message?", etc, there were cases where the user would not hear them as repair initiators but give them a meaning that would be relevant to what she thought was going on in the discussion (see Raudaskoski, 1990, for a more detailed description).

Conclusions

The study so far has given some interesting preliminary results of the nature of repair work in different kinds of situations where various sorts of resources are at a participant's disposal. The provisional analyses indicate that the whole concept of repair work needs an overhaul in order to sort out the family resemblances. The general notion would be something like uncertainty of understanding, of which clear-cut repairs are a subsection. Self explicating artifacts are not solely a matter of providing an enculturated and linguistically able, straightforwardly clear user interface. The negotiation of meaning, of which repair work is an outstanding example, is a continuous process. This is what we are doing with other people, thus an understanding of repair in human behaviour will help clarify what is feasible and required for successful *active* self explication in artifact design and use.

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